

Does Improved Growth Mean Improved Neurobehavioral Development?

Dear Editor:

In their recent Perspective “What does stunting really mean? A critical review of the evidence” Leroy and Frongillo (1) distinguished between stunted growth, or linear growth restriction, as a *marker* as distinct from a *cause* of deficits in children’s health, development, and well-being. They argued that despite consistent associations between stunted growth and delayed cognitive development, there is little evidence for a causal link between the two. We agree. At a symposium at the American Society for Nutrition annual conference in June 2018, we presented evidence from several sources that supports and further clarifies this distinction.

Based on the use of data from 4 cohorts of >4000 children in Malawi, Ghana, and Burkina Faso, path analyses of 42 risk factors for 18-mo length-for-age *z* score (LAZ), language, and motor scores showed that pathways to these outcomes were only partially shared (2, 3). Shared correlates were child dietary diversity, hemoglobin concentration, and LAZ at birth. Key predictors of LAZ but not developmental scores were maternal height and BMI, pregnancy duration, and diarrhea incidence. Key predictors of developmental scores but not LAZ were indicators of the child’s variety of play materials and activities with caregivers. These findings suggest that environmental factors constraining growth and development overlap only in part.

In a second path analysis conducted with data from additional cohorts of >5000 children in Ethiopia, India, Peru, and Vietnam, linear growth from age 1 through 12 y accounted for only 0.4–3.4% of the variance in cognitive and academic achievement scores at age 12 y (4). A similar pattern of relatively small associations of linear growth from birth through age 9–12 y with cognitive and academic scores at 9–12 y was found in a cohort of >2000 children in Indonesia (5). In both studies, parental and household factors, such as maternal and paternal education and indicators of the home environment, more strongly predicted children’s cognitive and school achievement than did linear growth. Conversely, in an analysis of birth cohort data from Brazil, India, the Philippines, and South Africa, LAZ at age 24 mo was more strongly predicted by biological factors (maternal height and child birth weight) than by socioeconomic factors, including measures of the child’s environment, maternal schooling, and housing quality, among others (6).

We agree with Leroy and Frongillo that the research and public health communities need to clarify our thinking and language around the association between stunted growth and neurobehavioral development. Linear growth and

neurodevelopment are different physiologic processes, with some shared determinants and some distinct determinants. Stunted growth is a marker of an environment that constrains growth and development through partly overlapping mechanisms. Child development can improve without seeing changes in growth, and child development does not necessarily improve when growth faltering is reduced. Nutritional interventions have approximately one-third the effect on neurobehavioral development compared with nurturing and stimulation interventions (7). Our public health community should create interventions to improve child development that identify and address risk factors for poor neurodevelopment in the population, and not assume that improved growth alone will appreciably improve child development. Although measuring child development is more difficult than measuring height, the WHO Global Scales of Early Development, which are currently under development, may provide a practical tool to facilitate standardized measurement of child development in program evaluations and population monitoring.

In addition, and most crucially, we should work toward building an evidence-based comprehensive intervention package that addresses the determinants of neurobehavioral development, which will likely include nutrition, other biomedical interventions, and most importantly, aspects of nurturing care and learning opportunities (8). Critically, we need to determine what intervention package and implementation platforms most effectively enhance nutrition and especially nurturing care on a large scale with high quality and fidelity and improve child development, thereby leading to not only taller, but more thriving populations.

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